

# BA3520 BA3520F

## 3 V dual pre- and power amplifier

The BA3520 and BA3520F ICs are dual channel preamplifier and power amplifiers that contain all basic signal circuits necessary for a tape player.

The preamplifiers are direct coupled and the power amplifiers have a built-in fixed-gain NF circuit, making an output coupling capacitor unnecessary.

### Features

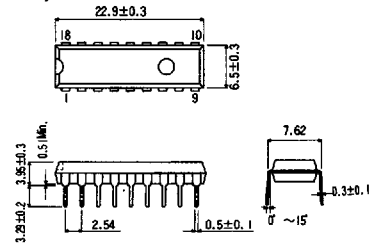
- available in DIP18 and SOP18 packages
- low voltage operation (1.8 – 4.0 Vdc)
- preamplifier has high voltage gain (78 dB), low noise ( $1.1 \mu\text{V}_{\text{rms}}$ ) and low distortion (0.03%).
- power amplifier has high output ( $30 \text{ mW} \times 2$ ), low noise ( $50 \mu\text{V}_{\text{rms}}$ ) and low distortion (0.5%)
- has a built in EVR. A-curve characteristics for EVR obtained are from the VR of the B-curve
- no oscillation protector required for power amplifier
- built in muting circuit

### Applications

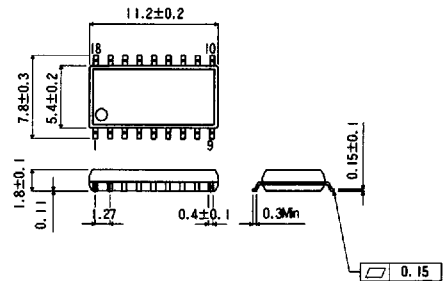
- 3 V tape player
- 3 V radio cassette player

### Dimensions (Units : mm)

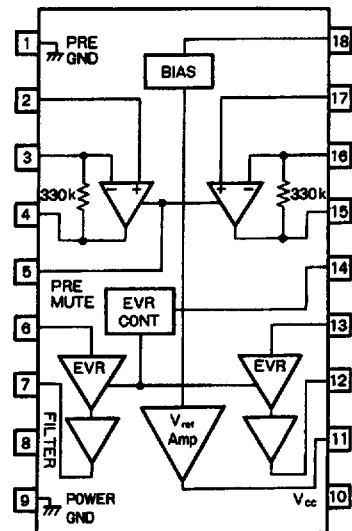
#### BA3520 (DIP18)



#### BA3520F (SOP18)



### Block diagram



**Absolute maximum ratings (T<sub>a</sub> = 25°C)**

Parameter	Symbol	Limits	Unit	Conditions
Power supply voltage	V <sub>CC</sub>	6.0	V	
Power dissipation	BA3520	1000	mW	Reduce power by 10 mW for each degree above 25°C.
	BA3520F	550		Reduce power by 5.5 mW for each degree above 25°C. Mounted on a 50 × 50 × 1.6 mm glass epoxy PCB.
Operating temperature	T <sub>opr</sub>	-25 ~ +75	°C	
Storage temperature	T <sub>stg</sub>	-55 ~ +125	°C	

**Recommended operating conditions (T<sub>a</sub> = 25°C)**

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Power supply voltage	V <sub>CC</sub>	1.8	3.0	4.0	V	

**Electrical characteristics (unless otherwise noted, T<sub>a</sub> = 25°C, V<sub>CC</sub> = 3 V, f = 1 kHz)  
(Sheet 1 of 2)**

Parameter	Symbol	Min	Typical	Max	Unit	Conditions
Quiescent current	I <sub>Q</sub>	10	15	20	mA	V <sub>IN</sub> = 0 V <sub>rms</sub>
Channel separation	CS	30	40		dB	R <sub>G</sub> = 2.2 kΩ, R <sub>L</sub> = 32 Ω
<b>Preamplifier (R<sub>L</sub> = R<sub>IN</sub> (EVR))</b>						
Open loop voltage gain	G <sub>VO</sub>	72	78		dB	V <sub>O</sub> = 200 mV <sub>rms</sub>
Closed loop voltage gain	G <sub>VC1</sub>	28	31	34	dB	V <sub>O</sub> = 100 mV <sub>rms</sub>
Output voltage	V <sub>OM</sub>	300	500		mV <sub>rms</sub>	THD = 1%
Total harmonic distortion	THD <sub>1</sub>		0.03	0.15	%	V <sub>O</sub> = 0.2 V <sub>rms</sub>
Input bias current	I <sub>B1</sub>		100	300	nA	V <sub>IN</sub> = 0 V <sub>rms</sub>
Input conversion noise voltage	V <sub>NIN</sub>		1.1	1.8	μV <sub>rms</sub>	R <sub>G</sub> = 2.2 kΩ, BPF = 20 Hz ~ 20 kHz
Ripple rejection	RR <sub>1</sub>	59	65		dB	V <sub>RR</sub> = -20 dBV, f <sub>RR</sub> = 100 Hz
<b>Power amplifier (R<sub>L</sub> = 32Ω) (except P<sub>OUT1</sub>)</b>						
Rated output 1	P <sub>OUT1</sub>	25	30		mW/ch	R <sub>L</sub> = 16 Ω, THD = 10%
Rated output 2	P <sub>OUT2</sub>	15	18		mW/ch	R <sub>L</sub> = 32 Ω, THD = 10%
Closed loop voltage gain	G <sub>VC2</sub>	33	36	39	dB	V <sub>O</sub> = 300 mV <sub>rms</sub>
Total harmonic distortion	THD <sub>2</sub>		0.5	1.5	%	EVR = max, P <sub>O</sub> = 5 mW
Output noise voltage	V <sub>NO</sub>		50	80	μV <sub>rms</sub>	EVR = min, BPF = 20 Hz ~ 20 kHz

**BA3520, BA3520F** Pre- and power amplifiers for headphone stereos

**Electrical characteristics (unless otherwise noted,  $T_a = 25^\circ\text{C}$ ,  $V_{CC} = 3\text{ V}$ ,  $f = 1\text{ kHz}$ )**  
 (Sheet 2 of 2)

Parameter	Symbol	Min	Typical	Max	Unit	Conditions
Ripple rejection	$RR_2$	60	65		dB	$V_{RR} = -20\text{ dBV}$ , $f_{RR} = 100\text{ Hz}$ ,
EVR input resistance	$R_{IN}$	21	30	39	$k\Omega$	
EVR attenuation ratio	ATT	70	80		dB	0 dB = -10 dBV, EVR = max When EVR = max, set the input so power amp output $V_0 = -10\text{ dBV}$ . Measure the attenuation of V when EVR = min in that state.

**Figure 1** Test circuit

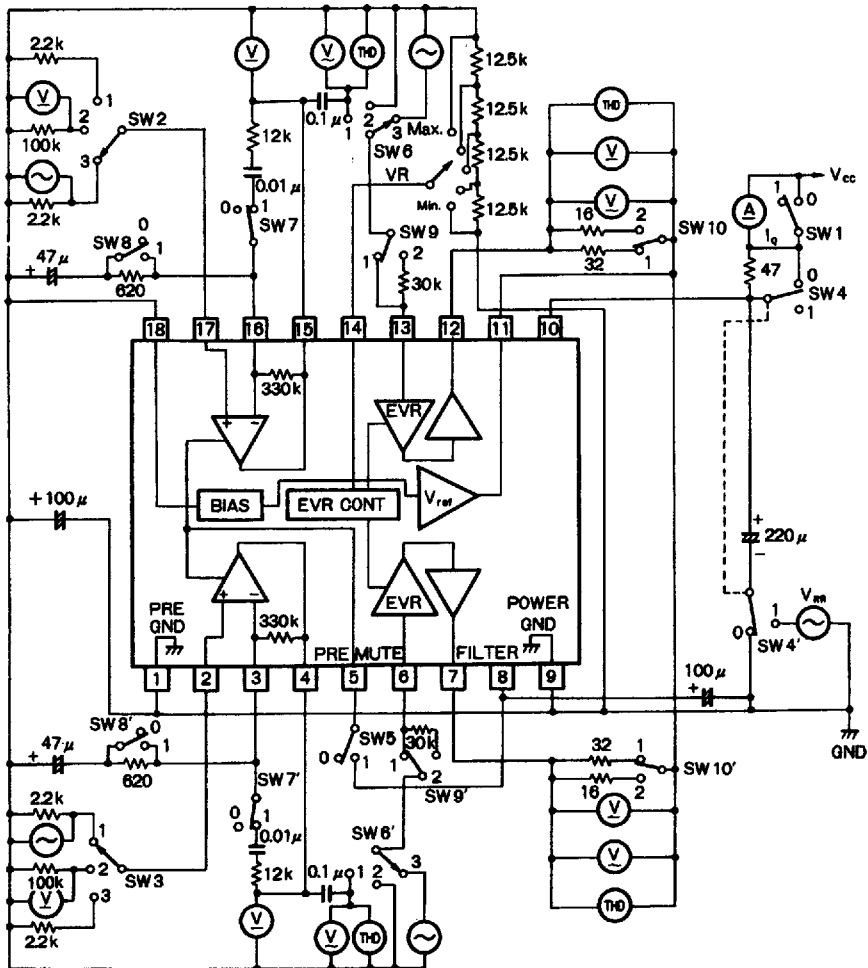
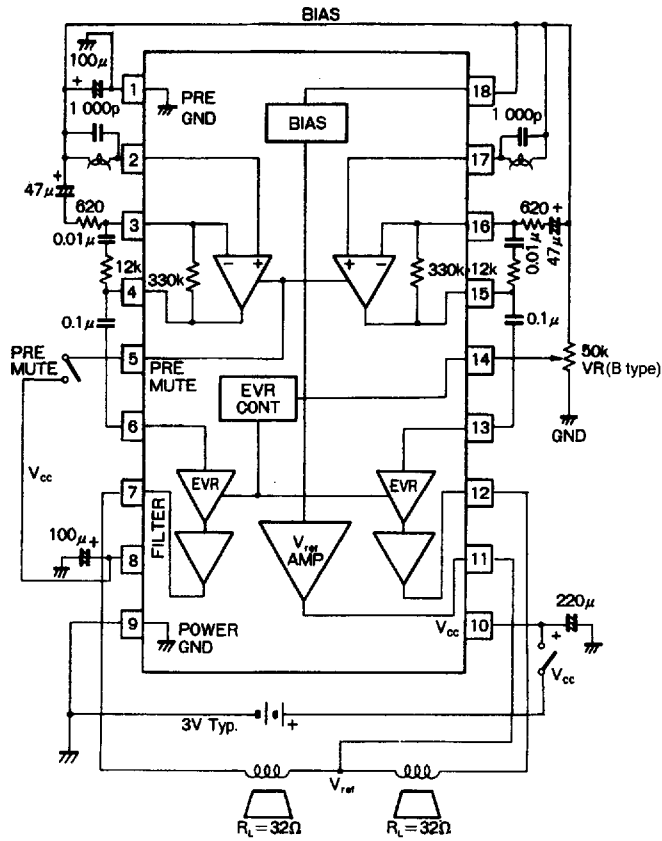


Figure 2 Application example



Gain and the dynamic range with EVR IN

Figure 3 EVR equivalent circuit diagram

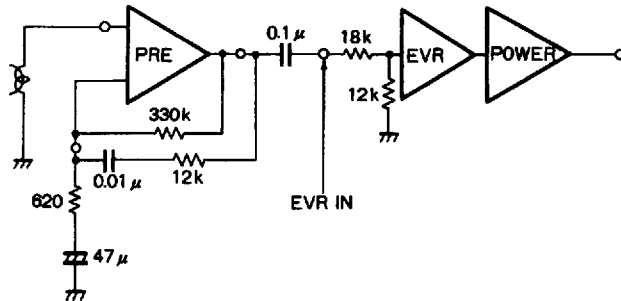
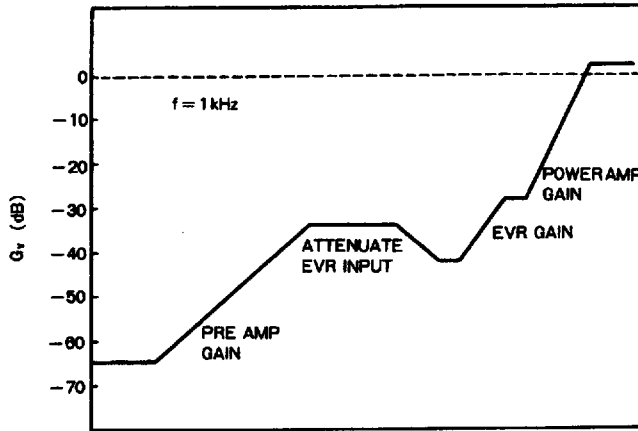


Figure 4 Gain distribution



The total harmonic distortion for the input dynamic range is a minimum for  $V_{IN} = -30.4 \text{ dBV}$  as shown in Figure 7. A gain distribution for the application example is shown in Figure 4.

**Note:** When connecting to a graphic equalizer it is necessary to set the signal level so that it does not exceed the limitations to the EVR IN.

Electrical characteristic curves

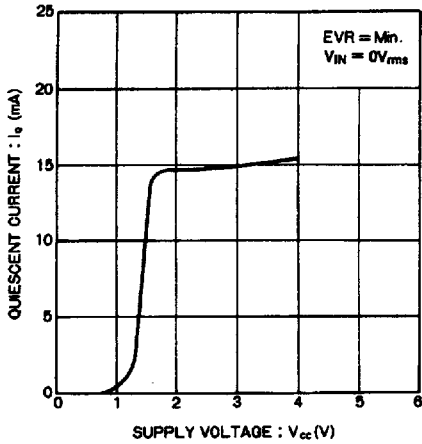


Figure 5

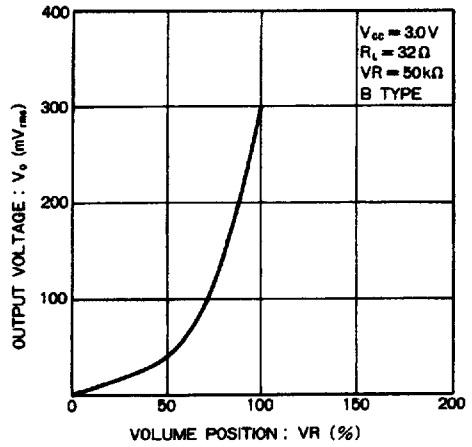


Figure 6

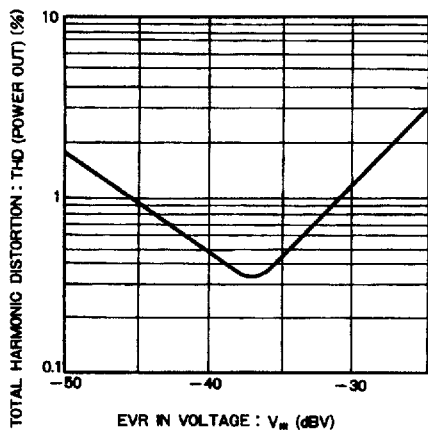


Figure 7

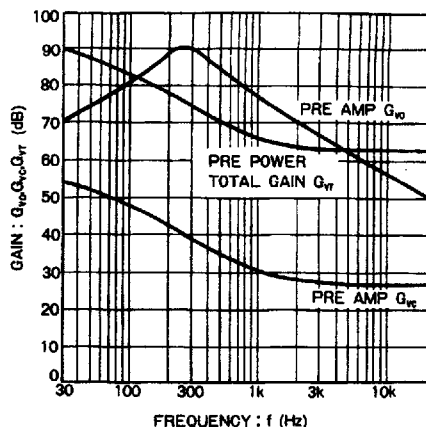


Figure 8

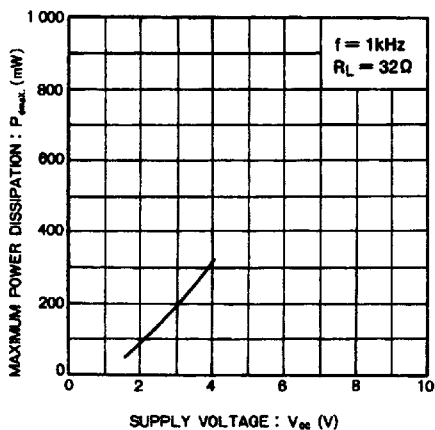


Figure 9

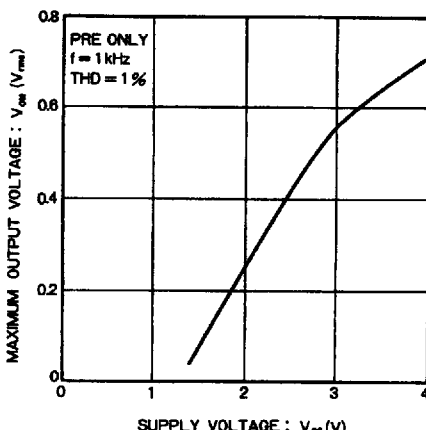


Figure 10

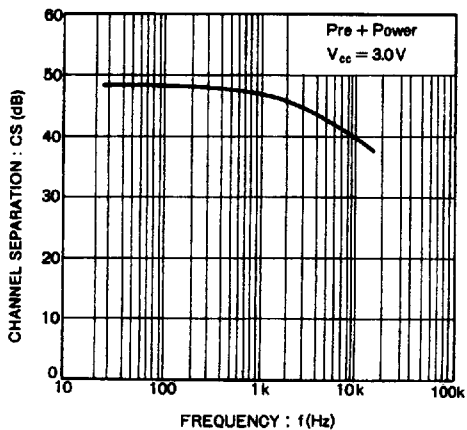


Figure 11

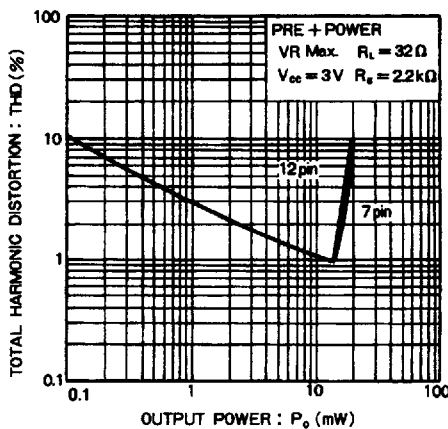


Figure 12